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TWO NEW EMBIIDÆ.[1]

AXEL LEONARD MELANDER.

The singular and primitive family Embidæ of doubtful affinities is represented by not more than a score of living species and a few preserved in amber. Of these nearly one half are known from fewer than five specimens each. Up to 1885, the date of publication of Hagen's Monograph of this family,[2] only fifteen living species had been recorded. Since that time less than a half dozen species have been discovered, so that even now this family remains one of the most poorly represented of the insect world.

The habits of three or four species have been studied to some extent, but only of *Embia solieri* Rambur do we know anything at all approaching the whole postembryonic life-history. It is to Professor Grassi[3] that we owe this contribution. He worked out the internal anatomy of this species and showed how the nests in which it lives are spun by the insect's forefeet instead of by its mouth-parts as had been previously supposed. The object of the present paper is to call attention to two new forms, one from Texas and one from Mexico, and to the peculiar structure of the spinning organ.

Up to the present time only two species have been taken on this continent, one, *Embia* (*Oligotoma*) *hubbardi* Hagen, in Florida and one, *Olyntha salvini* McLachan in Mexico. The new forms probably belong to these same genera, though one of them is here placed in *Embia*. This is done, not because it ought not to be included in *Oligotoma*, where its nearest allies are placed, but because it is believed that the genus *Oligotoma* is untenable. The two genera are separated only by a peculiarity of wing neuration, but Grassi has shown that the adults of

[1] Contributions from the Zoölogical Laboratory of the University of Texas, No. 16.

[2] Hagen, H., Monograph of the Embidina, *Canadian Entomologist*, Vol. XVII.,, pp. 141–155, 171–178, 190–199, 206–229.

[3] Costituzione e Svillupo della Societa die Termitidi . . . con un' Appendice . . . sulla Famiglia delle Embidini. Catania, 1893.

Embia solieri are wingless, so that in this case the character can not apply. None of the specimens of either of the new species show any traces of wings, although those of the Texan species which were sectioned possess spermatozoa nearly matured. It is interesting to note the distribution of the North American genera. The two *Olynthas* were taken on nearly the same parallel of latitude, and this is also the case with the two *Embias*.

The types of the two new species are deposited in the Museum of Comparative Zoölogy, which also contains the material worked over by Dr. Hagen.

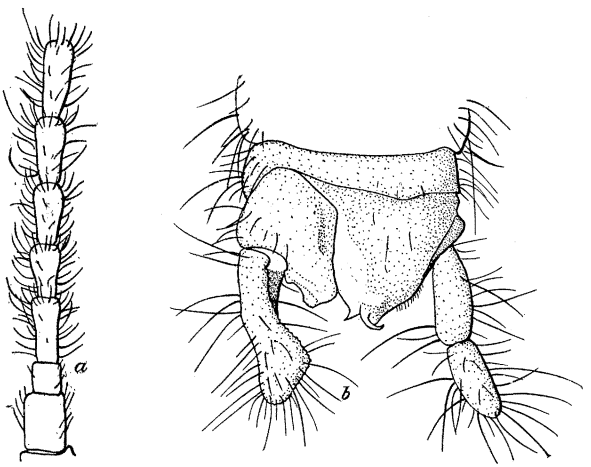

FIG. 1. *Olyntha wheeleri*, sp. nov. *a*, base of antenna; *b*, dorsal view of tip of abdomen.

OLYNTHA WHEELERI, sp. nov. (Fig. 1.)

Length, 6.5 mm. Body black, very lightly subpruinose, punctulate, subglabrous. Insect sparsely covered with fine pale hairs and slender black bristles scattered on antennæ, above eyes, on femora, dense on under surface of four posterior metatarsi, more sparsely on lateral edges of thorax and abdomen, and long on anal appendages. Antennæ somewhat defective, but with twenty joints present, which together are longer than head and thorax; basal joint stout, cylindrical, second one fourth less in diameter, its length and diameter equal, first and second joints piceous, with no erect black bristles, remaining joints dark fuscous with black radiating bristles, third antennal joint equal to two basals, its sides concave, remaining joints elongate pyriform, thicker beyond middle, fourth shorter, fifth to sixteenth subequal, seventeenth to twentieth a little shorter. Labial palpi rather

thick. Maxillary palpi plainly five-jointed, second and third joints subequal, each a little shorter than first, fourth longer than first but more slender, fifth not longer than third plus the fourth, with numerous pale hairs. The bases of the maxillæ and the galeæ are testaceous, remainder of head black. Thorax flattened above, the mesothorax larger than the others, evenly black, no color markings. Legs black, last tarsal joint alutaceous at tip, ungues pale with piceous apex; fore metatarsi greatly enlarged, with pale recurved hairs along edge of lower surface, middle joint with similar hairs: tarsi of four posterior legs slender, metatarsi with a dense brush of thick, short, black bristles beneath, middle joint with paler papilla, third joint slender, long; middle legs slender; posterior femora much incrassated. Left anal appendage one-jointed, but articulated with the body, stout, large, clavate, obliquely truncate at tip, lightly rugose. Right appendage two-jointed as usual, the apical joint shorter and thinner than the basal. Both appendages have many long brown to black hairs. Between the appendages are two triangular lamellæ. The left one testaceous, the right one black and testaceous apically: each armed with an apical spine pointing transversely outward. The median portion of the last ventral segment is placed largely towards the right. From the upper surface the secondary sexual characters present a different aspect. The terminal abdominal segment (10th) is obliquely cleft, the cleavage starting near the left side and terminating nearly midway between the appendages. The left portion is prolonged into a hastate slender projection. Near the base of the left appendage arises a flat lighter-colored triangular process (seen from below as the left triangular lamella). This overlies the hastate projection. The right portion of the last segment terminates in a flattened bifurcate process, the outer tooth of which is bent downward and the upper tooth to the right. The ninth abdominal dorsal segment is very narrow, of about one third the depth of the others: its posterior margin is arcuate, bulging outward on the right side and emarginate on the left.

From above the head is one half longer than broad, wide at the rather prominent eyes and then sloping suddenly forward and less so behind the eyes; hind angles very oblique; head not at all quadrangular in outline; no impressed markings; surface evenly, finely rugulose.

Among other characters, the shape of the head, the structure of the antennæ, the color of the hairs and body and the remarkable sexual organs are peculiar to this species and readily distinguish it from the other species of *Olyntha*.

One wingless specimen from Cuernavaca, Mexico, taken December 26, 1900, by Dr. Wm. W. Wheeler while excavating a nest of *Leptogenys wheeleri* Forel.

EMBIA TEXANA, sp. nov. (Figs. 2 and 3.)

Immature Male.—Length, 5–7 mm. Rufous. Antennæ pale fuscous, when folded back reaching to second pair of legs, filiform with small testaceous setæ. First three joints more or less quadrate, others rounded, first joint rather thicker than the others, a little longer than broad : second the palest, as long as broad : third pale at base, nearly twice as long as broad : fourth and fifth but little longer than broad : remaining joints gradually increasing in length, last three joints twice as long as wide, their diameter nearly equal to that at base. No more than sixteen joints were

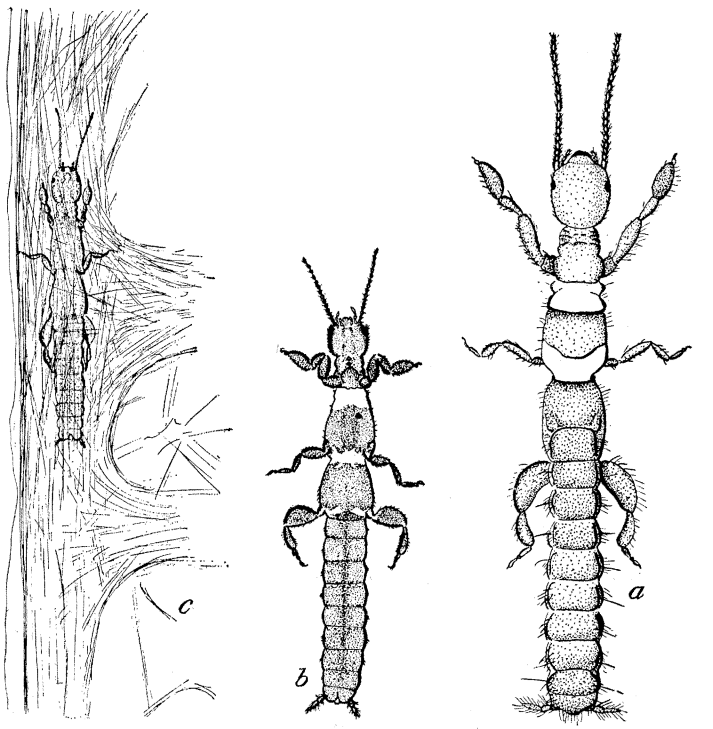

FIG. 2. *Embia texana*, sp. nov. *a*, dorsal view ; *b*, ventral view ; *c*, insect in web.

counted in any one specimen. Each antennal joint has a small pale space at its base. The 5-jointed maxillary palpi become paler apically and have the first joint connate with the head, second joint very short, third, fourth and fifth gradually increasing in length and decreasing in breadth, fifth a little longer than the two preceding together. Third joint of the labial palpi broad, yellow. Galeæ yellow, prominent, broad. Mentum and submentum rufous, as is a large W-shaped mark on the lower side of the head. Eyes oblique, black, consisting of about fifty facets. Neck tri-

angular beneath, with two small rufous tubercles, between which are the apices of two rufous triangles. The thoracic sclerites transverse, rufous, separated by colorless thin chitin. The sterna are well-marked. Abdominal sclerites more firmly chitinized than thorax and therefore darker red. Anal plate divided, a little asymmetrically, the right piece with a slight subapical notch on inside where there is a transverse carina. If any differences exist in the anal styles the basal joint of the left is a little stouter. Legs rufous except middle and hind coxæ and trochanters, knees, and last tarsal joint. The fore and hind femora are strongly incrassate as are the fore tibiæ and tarsi. Under side of the front metatarsi nearly plane, beset with minute and with moderately long bristles, the longer set recurved at tip. Remainder of legs and body covered with scattered pale yellow

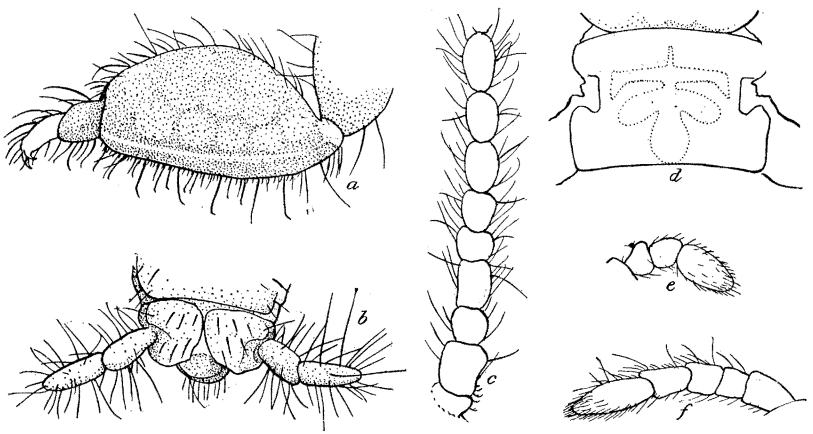

FIG. 3. *Embia texana*. *a*, front tarsus; *b*, tip of dorsum of abdomen; *c*, base of antenna; *d*, prothoracic notum; *e*, labial palpus; *f*, maxillary palpus.

bristles which are longer on the anal styles. Upper side of head with three clear "ocellar" spots, a Y-shaped mark confluent with an inverted heart-shaped, basal space, on each side of which is a granulate clavate mark. The stem of the Y continues along the middorsal line of the thorax and more faintly along the basal segments of the abdomen. Upper side of the thorax with an inverted "fleur-de-lis"-shaped, granulate, clearer mark. These color-marks are sometimes faint. No traces of wings.

Eight specimens taken during the winter months, from November to March. Austin, Texas.

The following are the chief characters which separate the related species from the above-described form:

Embia (*Oligotoma*) *cubana* Hagen. *Winged male.* Head cut straight near the prothorax; last palpal joint long-conical; between anal styles above is a short bent process, on the left side

of which is a conical lobe, short, open at tip. *Wingless female.* Antennæ 18-jointed; last ventral segment not divided; above between appendages is a small thin elongated lobe.

Embia (*Oligotoma*) *hubbardi* Hag. *Winged male.* 4 mm. Head cut straight before prothorax; second joint of antennæ very small, annular; third joint as long as two basals, thicker on tip; fourth and fifth similar to third but a little shorter; abdomen pale brown.

Embia (*Oligotoma*) *insularis* McLachl. *Winged male.* Sixth antennal joint as long as third; apical joint of labial palpi ovoid; abdomen pale dirty brown; last ventral ending in a bottle-shaped tube which is turned to the left and partly surrounded by a horny hook.

Embia texana is very susceptible to differing degrees of humidity and therefore cannot be found at all seasons of the year. After the ground has been moistened by the winter rains the Embiids were found, the last one being taken during March. As soon as the overhead sun dries up the ground these insects are never seen, having burrowed deeply into the soil. One specimen was taken while ripping the bark from a fallen tree, all the others were found under stones; and of these one was found in company with *Formica fusca* L. var. *gnava* Buckley, though its association with the ants was accidental, no doubt, as was shown by its hurry to escape. In this connection attention may be called to the occurrence of the *Olyntha* in the nest of *Leptogenys*. *Embia texana* is apparently not rare in this vicinity, two having been taken in a single day, though from its neat manner of concealment and its limited time of appearance it is found only by the merest chance. The species has been taken in localities about the city of Austin separated by over ten miles, places of different character, one a sandy tract, and the other a limestone hill.

The insects live singly in silken webs, spun by themselves. These webs are tunnels in some niche of the rock which shelters them, or spun between the grains of soil. They are an inch or more in length, and closed at one end, their diameter a little greater than the insect's body. Sometimes a small flat web is spun beneath the stone. The tunnels are provided with side-

passages ending, in the case under observation, blindly (Fig. 2, *c*). When the Embiid wishes to turn in its passage it backs partway into a side tunnel until its head is free to point the other way. This is not universal, however. *Embia* was several times seen to turn on itself, as its very supple body and unchitinized joints permit it to place the thorax in a line parallel with and touching its abdomen. During the daytime *Embia* seemed loath to quit its tunnel, and when forced out would always return to it in a few minutes. When in the tunnel it is completely concealed. This accounts for the few specimens, as all were taken when driven from their retreat on the removal of their stone.

It was stated by Hagen that the web is used in ensnaring prey. Its texture is far too delicate for that purpose, even were its size larger. *Embia's* silk is very different from spiders' webs. It is much more frail and of an opalescent whiteness which renders it distinguishable, after practice, from the spider webs common in the same situations. Grassi states: "Evidently the gallery serves to protect the body from too excessive transpiration, and to keep about the *Embia* an atmosphere not too dry," but it is difficult to see how a net can prevent excessive transpiration in a dry climate like that of Austin. The tunnels probably serve merely as a retreat. The insect seems entirely contented when at home and touching the meshes of its web, so that it may be described as strongly, positively thigmotactic. Indeed, it was frequently observed to stretch its front feet outward, in order to press its back against the soft silk.

When the web was touched, the Embiid darted out, sometimes head first and sometimes crawfishing. Its backward movements, however, are very different from its normal walk. In moving ahead *Embia* walks with a sinuous motion, bending its supple body slightly to accommodate the motions of its legs, and covering about two thirds of an inch, or less, in one second. Its recoils are more of a scurry from danger. It then travels a full inch in a second and in a straight path, though it never goes beyond an inch in any single dart. While walking, the abdomen is carried in a very unstaphylinid-like manner, the central part being elevated and the tip depressed. *Embia* was never observed to jump, though the incrassate and muscular femora would at first sight seem to indicate that habit.

One of the *Embias* was kept in a small culture dish with a few grains of sand. The first night it spun along the edge of the glass a web in which it remained the two following days. Then it discovered the sand in the center of its room and spun another gallery between the surface of the glass and the sand. In this position it was absolutely concealed, having completely covered the web with the small amount of sand present. *Embia* is exclusively nocturnal, at least in the nymphal state. Although the tunnel was in great part completed in a single night additions were made to it on several succeeding nights.

At first sight the silk resembles a very thin, pale gossamer, but when viewed under a strong magnification the individual threads are seen to be arranged in fine bundles of varying thickness. Most of the threads in a bundle lie parallel with one another, but the bundles contain a few curled threads also. The individual threads vary in diameter.

In making its web *Embia* does not use its mouth—notwithstanding Hagen's statement that spinning organs are present among the mouth parts—but it uses instead, its forefeet, as Grassi had shown. No other animal has developed spinning organs in this position. The silk is produced by large glands occupying nearly the whole of the enlarged metatarsus. The underside of this joint is provided with a dense mat of small short bristles, and interspersed among them are the longer spinning bristles, each of which is hollow and slightly recurved at the tip and contains a tenuous duct from the gland. While spinning, *Embia* very rapidly moves its forefeet, either singly or both together, now reaching out directly in front, now to the side, with a movement which reminds one of a cat toying with a string. Each time it touches a surface it attaches a bundle of silk. As the bundles are of varying sizes it would seem that sometimes all the glands function, at others only one.

While spinning its cylindrical retreat, *Embia* slowly rotates on its longitudinal axis. When within its nest it does not find it inconvenient to rest with head downward. It was seen resting on its side or back more frequently than with its ventral surface down. The soothing touch of its web seems to be suffi-

cient to insure a feeling of security no matter how its body may be placed. In its natural habitat the insect is normally found clinging to the under surface of its sheltering stone. But when driven from its gallery, *Embia* rebels if placed in an inverted position and rights itself immediately by wriggling the tail and clutching with the forefoot, which probably at the same moment emits a strand of silk.

The antennæ of *Embia* appear to be less sensitive to touch than the body. The insect would frequently butt against some obstruction notwithstanding the warning received through the antennæ. On one occasion the warning was insufficient to prevent *Embia* from walking into a drop of honey, and after an enforced bath the insect seemed more solicitous of its forefeet than of the rest of its body, carefully eating off the honey from their plantar surfaces. When about to clean its antennæ *Embia* rapidly turned its head and thus brought one of these organs under the body and then standing over it gradually drew it forward, at the same time eating off the honey. This was the only time the insect was observed to eat anything of a vegetable origin, and then it was only with great reluctance. On several occasions small pieces of a worm and a fly attracted its attention but after a few nibbles it would run away. The abandoned web at the edge of the jar seemed to be a more toothsome morsel, for *Embia* was frequently observed nibbling at it.

The spinning glands of *Embia* (Fig. 4) are unique and without parallel. The silk is produced in the thickened anterior metatarsi within chambers and conducted outside to the recurved hairs at the edge of the plantar surface. The chambers of the metatarsus which may be seen shining through the chitinous integument, appear more or less regularly arranged in three longitudinal layers, one next to the sole, a second in the middle, and a third dorsally. In each series there are, roughly estimated, about twenty-five chambers, placed about three abreast. Thus in the whole joint the chambers number between seventy-five and eighty. The cavities are nearly all of the same size—about sixty micra in diameter—though the outer chambers are somewhat smaller. Each chamber is more or less cuboidal and bounded by a single layer of epithelium. This is for the most part quite

thin and flattened in the central part of the faces, but becomes columnar at the corners. Cell-boundaries are not easily seen. The large central space of each chamber is filled with a colloid secretion, more or less shrunken in alcoholic material. This substance, the silk, is carried to the tips of the hairs through ducts of varying length, one from each chamber (Fig. 4, *b*). The terminal hairs (Fig. 4, *a*) are arranged in a row around the edge of the plantar surface of both the metatarsus and the second tarsal joint. Though the latter is devoid of any secreting gland it possesses several ducts leading through it from the metatarsus. Some of the ducts lead along the periphery of the joint, others

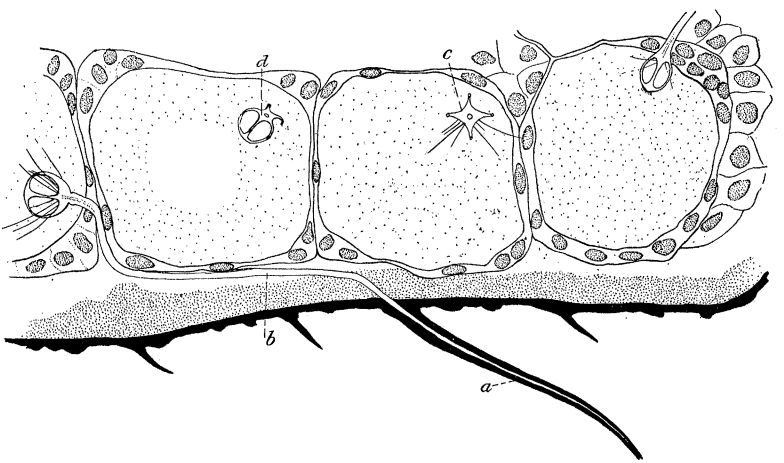

FIG. 4. *Embia texana.* Portion of metatarsus, showing glands; *a*, spinning bristle; *b*, duct of silk-tube; *c*, ampulla at base of duct.

pass between the gland-chambers. The foot-tendon lies in large part between the two lower series of glands.

In the glands, each duct arises from a remarkable ampulla (Fig. 4, *c*, *d*, *e*). The wall of the duct suddenly becomes thickened, and then subdivides into four or five rays, which are continued in the form of the equidistant meridians of a sphere and meet again in an end-plate opposite the point of subdivision. Thus the lumen of each duct terminates proximally in four, or rarely five, large, elliptical or ovoid, lateral openings. At the base of each opening is a radial arrangement of fine processes, possibly the expression of the silk being drawn into the lumen of the tube.

UNIVERSITY OF TEXAS, AUSTIN, TEXAS, March 22, 1901.

Postscript.

Since the foregoing account was written we have met with *Embia texana* a number of times, while on two occasions several specimens were associated in the same nest. In the former of these cases the retreat was the combined efforts of six individuals, in the latter but three specimens resided together. These family homes are larger than those of the solitary *Embias*, extending for several inches and consisting of a large mass of silk. As none of the specimens observed show any trace of wing-formation, our previous conclusion, that this species is wingless, is probably correct.

Austin, Texas, March 22, 1902.